EVOLVED SEA SPARROW MISSILE (ESSM)

Navy ACAT II Program

Total Number of Systems:	2,076 (U.S. only)
Total Program Cost (TY$):	$1,572M (EMD & Production)
Average Unit Cost (TY$):	$0.50M
Full-rate production:	FY03

Prime Contractor

Raytheon Systems Company
Tucson, AZ

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The Evolved Sea Sparrow Missile (ESSM) is a short-range missile intended to provide self-protection for surface ships. On Aegis ships, ESSM will be launched from the MK 41 Vertical Launch System, requiring a thrust vector control system on the ESSM tail control section. On non-Aegis ships (aircraft carriers, amphibious assault ships, other surface combatants), it may be fired from other launch systems. ESSM uses an 8-inch diameter forebody which includes a modified guidance section from the in-service RIM-7P Sea Sparrow. The guidance section, which includes a radome-protected antenna for semi-active homing, attaches to a new warhead section. The forebody is attached to a new 10-inch diameter rocket motor, which provides higher thrust for longer duration and improved insensitive munitions than predecessor Sea Sparrow missiles. ESSM will use skid-to-turn steering (tail control), whereas earlier Sea Sparrows were wing-controlled. ESSM will expand the capability of the RIM-7P missile to add capability against maneuvering anti-ship missiles. ESSM is being developed as a multinational cooperative effort with several allied nations.

ESSM contributes to the ***Joint Vision 2010*** concept of ***full-dimensional protection*** by enhancing ship self-protection against air threats that have "leaked" past outer air defenses. Given that some of the ships that will use ESSM are also platforms from which strike operations are executed, ESSM indirectly contributes to the concept of ***precision engagement***.

BACKGROUND INFORMATION

Milestone II was conducted in November 1994. The TEMP was approved by OSD in January 1995, through the first at sea phase of developmental testing. The results of this testing were supposed to provide the data for an operational assessment supporting the LRIP decision. This provisional approval was assigned because the aerial targets proposed in the TEMP for the DT and OT (in support of the full production decision) were unacceptable in adequately representing anti-ship cruise missile threats. (Since that time, the PEO (TSC) has taken initiatives to obtain targets that are more threat-representative.) During 1998, the program was restructured with an OA based on missile flights in FY00 at White Sands Missile Range, NM, to support the initial LRIP decision. A second LRIP decision was added and will be supported by testing with the Self Defense Test Ship. The full production decision will be supported by an OPEVAL in late 2002, conducted with an Aegis destroyer.

TEST & EVALUATION ACTIVITY

FY99 activity included planning for and conducting initial test flights for the DT at the White Sands Missile Range, NM. The DT consists of firing both control test vehicles (CTVs) and guidance test vehicles (GTVs). CTVs are ESSMs with dummy guidance sections, programmed to execute maneuver patterns. GTVs are ESSMs with guidance sections for homing on targets. The first CTV firing was conducted in September 1998, followed by CTV firings in February, May, and November 1999. The first and third firings were from a MK 29 rail launcher, while the second and fourth were from a Mk 41 vertical launch cell. GTV flights are expected to begin in the second quarter of FY00.

Activity also included the planning for the FY00 DT/OT on the Self Defense Test Ship. The firing test matrix, with scenarios using either anti-ship cruise missiles or surrogates, was defined.

TEST & EVALUATION ASSESSMENT

CTV Results. Primary objectives of the four CTV flights were to demonstrate kinematic capability and aerodynamic control during high G maneuvers, evaluate autopilot stability, and collect data to validate simulations. Autopilot performance was closely monitored during these flights, with design changes implemented as the flight series progressed. A "tactical" autopilot was used in the third flight, but performance was marred by loss of roll stability during an early maneuver, resulting in high roll rates that exceeded the capability of the inertial measurement unit. As a result, the autopilot gains were adversely affected for the remainder of the flight. The initial loss of stability was caused by incorrect entries in the autopilot software. A problem that persisted at least through the first three flights was that the rear reference antenna, located near the rocket motor exhaust, suffered thermal damage to its radome that could have affected RF properties. (During the fourth CTV flight, the thrust vector controller failed to detach, thereby shielding the antenna from thermal damage.) The Program Manager is pursuing a solution to the rear reference antenna problem. Other anomalies observed during the CTV

tests included loss of the seeker antenna radome during the first flight test and a battery failure during the second flight test. Causes of these anomalies were determined and the problems were fixed.

GTV phase: The GTV phase will serve as the basis for an OA by COMOPTEVFOR. The OA will support an LRIP decision. However, there are significant limitations accompanying the testing of ship-launched missiles at the White Sands Missile Range that will qualify conclusions drawn from the results of the testing. Foremost among these is the decidedly non-maritime nature of the high desert environment. The harsh environment encountered when engaging sea-skimming anti-ship cruise missiles cannot be adequately represented because targets cannot be flown low enough and the radar reflectivity characteristics of the sea surface cannot be represented. Further, the fire control system at White Sands Missile Range differs in many respects from those used on ships firing ESSMs.

Self Defense Test Ship Phase. The DT/OT scheduled for FY01 on the Self Defense Test Ship promises to be very realistic, with the opportunity to learn more about ESSM capability in the actual operational environment. However, given the corroded condition of the 43 year old hull of the test ship, a concerted effort will be required to get the test ship prepared and maintain it through completion of this important testing phase.

Interoperability with Aegis Weapon System. ESSMs are intended to provide close-in defense of Aegis ships against anti-ship cruise missiles, with Standard Missile providing interceptor capability at longer ranges (both self defense and defense for other ships.) There are circumstances where the Aegis Weapon System could be controlling both ESSMs and SM-2s simultaneously. This is primarily an Aegis Weapon System (Baseline 6.3) issue that requires operational testing, either during the ESSM OPEVAL or during DDG-51 FOT&E.